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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/602,266	06/23/2003	Masao Moriguchi	SLA0770	1706

55286 7590 06/08/2009

SHARP LABORATORIES OF AMERICA, INC.
C/O LAW OFFICE OF GERALD MALISZEWSKI
P.O. BOX 270829
SAN DIEGO, CA 92198-2829

EXAMINER	
PADGETT, MARIANNE L	
ART UNIT	PAPER NUMBER
1792	

MAIL DATE	DELIVERY MODE
06/08/2009	PAPER

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/602,266
Filing Date: June 23, 2003
Appellant(s): MORIGUCHI ET AL.

Gerald Maliszewski
For Appellant

EXAMINER'S ANSWER

This is in response to the **Appeal Brief** filed **3/28/2009** appealing from the Office action mailed **9/17/2008**.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is deficient. 37 CFR 41.37(c)(1)(v) requires the summary of claimed subject matter to include: (1) a concise explanation of the subject matter defined in each of the independent claims involved in the appeal, referring to the specification by page and line number, and to the drawing, if any, by reference characters and (2) for each independent claim involved in the appeal and for each dependent claim argued separately, every means plus function and step plus function as permitted by 35 U.S.C. 112, sixth paragraph, must be identified and the structure, material, or acts described in the specification as corresponding to each claimed function must be set forth with reference to the specification by page and line number, and to the drawing, if any, by reference characters. The brief is

deficient, **because** what appellants have cited page 6, lines 15-17 as supporting, "without rotating the silicon film, **and** without rotating the aperture patterns" (emphasis added), appellants' summary is essentially stating that rotating of the apertures pattern is the means of rotating the beams, but cited teachings do not actually necessitate this, and besides claim 1 is not excluding rotating the silicon film or excluding rotating the beams = rotating the aperture patterns. Claim 1 and its dependent claims, **as written, exclude both options**, while Appellants' page 6 citation, provides support for rotating either the substrate or the beamlets, with appellants' reasoning for why rotating the beams is the same as rotating the mask or the apertures, so appellants **have not provided** a showing of support for excluding **both** the taught options, i.e. the summary lacks support for excluding both rotating the silicon film & rotating the aperture patterns. Furthermore, appellants' summary appears to be implying that the claimed first and second apertures (actually sets of apertures) are in a single mask, however the actual claim language does not relate the 2 sets of apertures to any mask structure, thus does not require them to be in the same mask.

Also it is noted, that while the summary's introduction discusses the existence of grain boundaries in critical regions,

such as in transistor channel regions, as degrading performance, independent claim 1 has no discussion requiring either the presence or absence of grain boundaries, so lacks relevance thereto as presently claimed. Similarly, independent claim 65 explicitly requires the creation of grain boundaries, but never requires the process to remove any grain boundaries, thus also fails to have clear relevance to what appears to be been suggested as a critical issue.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is essentially correct.

Note clarification of the 103 grounds to show IM, which was incorporated-by-reference in the Sposili et al. primary references, previously mentioned as evidence, as follows:

Claims 1, 3-21, 23, 25-44 & 65-66 are rejected under 35 U.S.C. **103(a)** as being unpatentable over **Sposili et al.** ((6,908,835 B2) or WO 02/086954 A1, with mention of IM (6,368,945) as incorporated evidence), in view of **Yamazaki et al.** (5,894,137), plus **Fukunaga et al.** (2004/0142543 A1) or **Kawasaki et al.** (6,653,657 B2).

(8) Evidence Relied Upon

The following is a listing of the evidence (e.g., patents, publications, Official Notice, and admitted prior art) relied upon in the rejection of claims under appeal.

6,908,835 B2	SPOSILI et al.	June-2005
WO 02/086954	SPOSILI et al.	October-2002
5,894,137	YAMASAKI et al.	April-1999
2004/0142543 A1	FUKUNAGA et al.	July-2004
6,653,657 B2	KAWASAKI et al.	November-2003
6,368,945 B1	IM	April-2002

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

The following is a quotation of the **first** paragraph of **35 U.S.C. 112**:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The following is a quotation of the **second** paragraph of **35 U.S.C. 112**:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims **25-38 & 65-66** are rejected under 35 U.S.C. **112, second paragraph**, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The language in **claims 25, 28, 32 & 35** remains unclear or ambiguous, since for example, the representative phrase "annealing the first area **in response to** the first and second energy densities..." (emphasis added) found in **claim 25** has multiple possible meanings (i.e. its scope is ambiguous), as it can mean that the annealing is done at some time after application of these energy densities from the third & first lasers, required due to previous effects of the energy densities of these previously applied lasers. It could also mean that the annealing is caused by the energy applied by these two different lasers, but the amended claim language **as written** does not require any particular way that the annealing is "in response" to the energy densities, thus makes the scope of the claim unclear. It remains contrary to

Appellants' previous assertion on page 14 of their 1/28/2008 response, that the claim language require "additional limitations that are **performed concurrently** with the previously recited step of 'using a 2N-shot laser irradiation process...'" (emphasis added), since the claim as written remains silent as to when the method is "projecting...beam, with second energy density..." & there is no indication that the "annealing...in response to...energy densities employ**ed**..." (emphasis added of past tense) is concurrent, as while it includes the possibility that the annealing is directly caused by the energy densities, it also includes the possibility that the annealing is done at a later time due to the energy effects caused by the first and second laser beams energy densities. The phrase "in response to" **does not necessitate *what*** is being done to cause the annealing effects "in response to" the energy densities, i.e. "in response to" is NOT of the same **scope** or meaning as -- causes -- or -- induces --, which would necessitate more precise meanings, rather than an encompassing relatively unspecified relationship. Analogous clarity considerations are applicable to **claims 28, 32 & 35**.

The **preamble** of **claim 65** requires laterally growing crystal grains using previously annealed silicon film, hence since in the body of the claim, nothing being treated is designated as "previously annealed silicon film", since the only necessitated annealing takes place in the "using..." limitation (unclear whether it should be considered the previously annealed or to be treating something that was previously annealed!), & occurs via directional solidification (DS) in the second area, thus the separately claimed step of "in response to the DS annealing, laterally growing crystal grains" (plural), also in the second area, **is still** possibly implied by the preamble to be required to be **sequential to** the DS annealing, thus contrary to Appellants' stated intent (first page Remarks in response of 5/21/2008) of the growth being the results of the DS annealing, however the body of the claim is not commensurate scope with this interpretation of the preamble, nor clearly consistent with appellants' stated intent, as the language in the body of the claim does **not necessitate** the claimed "laterally growing..." to occur at any specific time with respect to either the "using..." or "forming..." limitations, only designating which area in which it

occurs & requiring no specific techniques to achieve the lateral growth of crystal grains in the second area. Also, contrary to Appellants' previously stated intent for the lateral growth to occur as a result of the DS annealing, while claim 65 as written is inclusive of this, it is also inclusive of requiring another step to produce the lateral growth due to the results of the DS annealing. Using a term that encompasses possibilities broader than a single meaning (e.g. Appellants' intent as stated on page 14 of the 5/21/08 response), requires the examiner to consider the broader possibilities as part of the claimed meaning. Alternately, the preamble could be considered to be requiring the silicon film employed in the process to have been annealed before any of the steps in the body of the claim, however there is no antecedence between the limitations introduced in the preamble & those used in the body of the claim to clarify this issue. Considered in light of the specification, this claim is further unclear, in that the lateral growth discussed in the specification, particularly in the support for these claims previously cited by Appellants (specification pages 5 & 8-10, which the examiner notes are illustrated in figures 1 & 6), only discusses the lateral growth being produced **by** the DS annealing, thus contradicting the implications of the preamble, such that the intended meaning of claim 65 may be considered unclear or ambiguous.

As Appellants have stated on the record with respect **claims 65-66**, that their intent is for the lateral growth to be as a result of the DS annealing, if they actually want their claims to mean this, it would be appropriate to amended independent claims 65, such that the preamble was commensurate scope & clearly connected to the steps in the body of the limitation & to use terminology that is not ambiguous or broadly encompassing, as is "in response to", such as -- wherein the DS annealing causes lateral growing crystal grains in the second area --, or -- the DS annealing results in lateral growing... --, or the like.

In **claim 66** as presently written, it is unclear what relationship the "grain boundaries previously defined in the second direction" have to the limitations introduced in independent claim 65, where "a second area defined by a pair of grain boundaries oriented in the first direction, intersecting a pair of grain

boundaries oriented in the second direction". The introduced, but not clearly differentiated or related "grain boundaries..." of claim 66, do not have an article necessitating antecedent basis to similar limitations of claim 65, but the "previously defined..." might be intended to refer to the pair of second direction grain boundaries of claim 65 (or less clearly to the "previously annealed..." in the preamble), but is not necessitated to do so, especially as having the second area defined by these two pairs of grain boundaries would imply that they are either just outside or on the edges of the second area, thus for the sequential annealing to be in the second area as claimed, one could not have the lateral growth occurring across this grain boundaries as required in claim 66 (i.e. implies, but does not necessitate that claims 66 & 65 are discussing different grain boundaries). Therefore, clarification of the relationships of the grain boundaries of claims 66 & 65 is needed to clearly understand what physical effects on crystalline microstructure are intended to be taking place (i.e. the scope) in these claims.

The examiner has previously noted, that with respect to DS annealed "quasi-single crystals" 612, 613 & 614 illustrated in figure 6, would correspond to the pairs of lines 624 & 626, 631 & 630, 630 & 633, respectively, illustrating grain boundaries in one direction in the grid, noting that second direction pairs of grain boundaries of these illustrated crystals are only consecutive for the crystal 612. It is additionally noted that the crystals indicated by 613 & 614 might illustrate what might have been intended in claim 66, as they appear to show crystals that were grown across the grid structure that might be considered equivalent to previous grain boundaries, but would appear to suggest second direction grain boundaries of claim 65 bracketing those referred to in claim 66, in order to create a logical sequence of events, but the claim language does not necessitate this as written due to the lack of clear relationships. The lack of clarity as to what is actually intended to be occurring hampers a useful discussion of these claims with respect to the prior art.

Claims **65-66** are rejected under 35 U.S.C. **112, first paragraph**, because the specification, while being enabling for **a crystallization procedure applied to amorphous silicon (a-Si) for making**

polycrystalline silicon that first employs the "2N-shot laser irradiation" techniques, as set forth in the specification, to produce claimed grain boundary configurations, then employs directional solidification that may laterally anneal an area defined by two pairs of grain boundaries, does NOT reasonably provide enablement for forming a polycrystalline structure from a silicon film having unlimited or unspecified microstructure, via techniques that need employ neither a laser nor the specific 2N-shot laser irradiation techniques to create a parallel grain boundary configuration, and may create the claimed plural laterally grown crystal grains in the second area via techniques other than the DS annealing process. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with these claims.

Claims **65-66** are rejected under 35 U.S.C. **112, first paragraph**, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

With respect to the above 112, first rejections on scope of the enablement & written description, the **claims 65-66** as presented & in view of cited support, appear to encompass **New Matter**, as they **are broader than the scope of the enabling disclosure**, as well as **ambiguously include** claiming lateral solidification to form crystal grains during a step other than, plus possibly after, DS annealing in the same (second) area. Specifically note that the original method claims 1-48, with only claim 1 being independent, all required 2N-shot laser irradiation process applied to amorphous silicon to form the polycrystalline structure, with dependent claim 3 indicating this 2N-shot laser irradiation process was producing grain boundaries structures as encompassed by independent claim 65, thus the original claims do not provide support for the broader scope of claims 65-66, which do not require use of laser in the microstructure formation. It is further noted that the Field of the Invention specifically specifies that the

process is "for laser irradiating silicon films to produce polycrystalline silicon, in selected areas, free of grain boundaries", which while a contradictory statement as phrased (anything that's polycrystalline must-have grain boundaries or it can't have plural crystals), clearly indicates the requirement of using a laser in forming the polycrystalline structure.

Appellants' previous citation of support on page 22 of the 1/28/2008 response for new claims 65-66, indicated support on **page 5, lines 1-14** of the specification, which is discussing the **DS annealing** growth process of polycrystalline grains as illustrated in figure 1 & specifically requires employing "laser beamlets width" (line 4) in producing the illustrated structures, indicating that at each step the grains grows laterally from crystal seeds of polycrystalline material formed in the previous step, hence only supports the **DS annealing producing the laterally** growing crystal grains, but does not support lateral growth at a separate step from the DS annealing, & this section does not discuss preceding substrate structure, hence is not germane to or does not relate the DS annealed lateral growth to substrate structure (i.e. grain boundaries) before the start of the DS process.

Appellants previously further cited **page 8, lines 1-page 10, line 26** as support. The examiner noted that these three pages discuss figure 6, which is directed to an "a-Si film", which has been treated by the "2N-shot process", which requires laser irradiation, as described in preceding sections (page 2, lines 20-22; page 3, lines 1-2 {on amorphous silicon}; page 6, lines 10-27+ describing figure 4 & treating a-Si), with page 3, lines 3-13 relating to grain boundaries (GB) formed by the 2N-shot laser irradiation, followed by employing the DS process to anneal & smooth/remove the grain boundaries. Page 8 has extensive discussion of grain boundaries formed by the 2N-shot laser irradiation process on a-Si film 60, illustrated in figure 6, & having grain boundary structure as claimed. The paragraph bridging pages 8-9 discusses "quasi-single crystals" with respect to the illustrated grain boundary grid, with various location options discussed, and the last two sentences of this paragraph supporting using DS annealing with respect to the GB grid & the last sentence suggesting lateral growth, although using different semantics.

The next two paragraphs discuss various DS annealed crystal structures with respect to grain boundaries, particularly a pair of two grain boundaries, which may or may not be consecutive, etc., but at no point does the disclosure suggest using any other techniques with or after the directional solidification annealing in order to produce the lateral growth of crystal grains in the second area defined by the two pairs of grain boundaries, nor suggest forming the GB grid without the 2N-shot laser irradiation process, or on a silicon film other than amorphous silicon.

For these reasons, these claims 65-67 as presented appear to encompass **New Matter**, as their scope is broader than suggested or enabled by the original specification

Claims **25-38** are rejected under 35 U.S.C. **112, first paragraph**, as failing to comply with the enablement requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

While it might be considered ambiguous as to whether these claims encompass any new matter due to their ambiguous amended language, since the contradictory description (see paragraph directly following) of the "flowchart" of figure 14 essentially suggests combining any of the limitations listed therein any-which-way, it could be considered that no such combination is new matter, however that does not mean that all such combinations are properly **enabled**, as merely ambiguously suggesting that any of a multitude of steps may be combined, does not necessitate enablement to do so, especially in the presence of contradictory suggestions. Note that this particular relates to the ambiguous "in response to" language employed in **claims 25, 28, 32 & 35**.

As was previously noted, in the paragraph bridging pages 21-22 starts by stating "Fig. 14 is a flowchart illustrating...", which is okay by itself, as the referenced figure shows a series of steps with **arrows** in between each step, thus explicitly indicating that each step in the box follows the one before, which is consistent with the classic meaning of "flowchart" & inherent in the drawing of the arrows.

However, this paragraph then goes on to say "Although the method in Fig. 14 is depicted as a sequence of numbered steps for clarity, no order should be inferred from the numbers unless explicitly stated". The examiner notes that the **arrows** in the figure may be considered an **explicit statement of order**, especially when it is explicitly called a flowchart, hence the specifications statement concerning order creates ambiguity. The further statement that "it should be understood that some of these steps may be skipped, performed in parallel, or performed without requirement of maintaining a strict order of sequence" is considered to contradict the meaning of "flowchart", the arrows, etc., and essentially say that figure 14 is an almost meaningless jumble of steps with unclear relationships to each other, unclear effects with respect to each other & no particular or necessary significance with respect each other, thus figure 14 **cannot** be said to really **enable** any process with any surety or clarity, as essentially any combination of steps are said to be represented by figure 14, it cannot be considered to have or enable any particular results. For example, in light of clearer sections of the specification, it appears that step "1410" could be considered to be providing a description of "step " 1404, such that figure 14 would appear to be requiring two different applications of iterative laser processes not clearly distinguishable, therefore this figure is really confusing & likely to confuse anyone who looks at it, so as to only provide confusion about what the inventive process really involves. As a consequence of the contradictory language with respect to the figure, none of the boxed/numbered steps of figure 14 can be considered to be provided any meaningful context or relationship with respect to any of the other steps.

Due to the confusion generated by figure 14 & its contradictory aspects & description, only those relationships with respect to figure 14 that are clearly set forth & the expected effects reasonably described or suggested, will be considered to provide adequate enablement for the suggested, but not actually detailed, unlimited possible combinations.

With respect **claim 25**, Appellants previously cited page 23, lines 8-19, which explains step 1407, however this description does not provide enablement for all possibilities of claims as written (see 112, 2nd paragraph rejection above), nor is the discussion on page 23 that explicitly states that the annealing is after exposing to an additional energy source, enabling for the breath of the claimed limitations; nor does this discussion in the specification enable when the additional energy source (possibly third laser beam) is applied with respect to the first laser; or explain how one uses both energy densities from sources applied at unspecified times with respect to each other, so that annealing occurs at a later time as indicated by "Then" on page 23. For these reasons, enablement of the further limitations of claim 25 & its dependent claims, is insufficient & unclear. Note it is also unknown how these additional steps of projecting a third laser beam & annealing would affect the previously required formation of polycrystalline silicon with the specific grain boundary configuration of claim 3, from which claim 25 depends, especially considering the discussion on page 23 of the specification sheds no light on this topic (i.e. the annealing may be performed to wipe out the presence of all grain boundaries or the like). Also, the **claim language** does **not** provide any clear relationship or timing with respect to the DS annealing that is also a claimed requirement, so no necessary or clear results can be determined as resulting from these additional limitations. The lack of clear enablement & clarity in the claims, means that they cannot even be read in light of the specification to clearly determine what effect is probably intended.

With respect to **claim 28**, page 23, lines 20-page 24, line 3 cited as support by Appellants, only teach exposing the first area to excimer laser light at some time in its existence, with no enablement for any particular effect or timing.

Claims 32 & 35, depend through claim 11, which further limits the DS process using a second laser beam, however again there's no clear relationship in the claims **as written** to **when** the further laser or lamp, respectively, is applied with respect to the laser used for the DS process, nor any clear relationship between "annealing in response to" & the independent claim's DS caused annealing.

Appellants previously cited page 25, lines 9-22 & step 1422, which only discusses using a laser for sequential annealing & does not related to the rest of the claimed process. Furthermore, figure 14, as pointed out above & supported by Appellants' own disclaimer in the specification concerning figure 14, cannot be said to provide specific enablement for any particular affects of any particular combination from its unlimited combinations. Appellants have additionally cited page 26, lines 1-23 & step 1419, however this teaching which states "... exposes the second area to an additional energy source. Then, annealing..." has the same or analogous deficiencies as pointed out above with respect to the citation beginning on page 23, line 8.

Claims 1, 3-20 1, 23 & 25-24 are rejected under 35 U.S.C. **112, first** paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In independent **claim 1**, Appellants have amended the series a process steps to exclude any techniques that rotates aperture patterns when performing the process, however with the amendment they did not appear to have cited any support for this negative limitation (merely not discussing rotation of an aperture or mask, was not considered to mean that Appellants necessarily have support for excluding such a procedure from their process). On page 20 of Appellants 5/21/2008 response Appellants allege that "mask rotation is not the subject of Appellants invention", however they did not cite support for this contention, nor for excluding mask rotation, nor did they provided any reasoning that would lead one to agree that the taught process would have excluded mask rotation. Appellants cited "support" in their Brief's "Summary" tries to equate aperture rotation with rotating beamlets from page 6, but the Summary is discussing the two excluded means of configuring as alternative exclusions, when the independent claim excludes both, so continues to fail to show support for the actual claim language.

As previously noted, the paragraph bridging pages 6-7 discussed the care that must be taken with respect to alignment when masks are moved, but neither specified the type of motion, nor actually prohibited moving the mask. The paragraph on page 19, lines 5-12 discussed using different beam shaping mask designs in LILaC processes, with general mention of "scanning schemes for the substrate (which moves under the mask)", which didn't limit the type of movement (lateral or rotational translation) nor necessarily exclude mask movement, with immediately following comments concerning the 2N-shot crystallization method being encompassed by this & described in the Background, but the examiner found no background discussion which had any relevance concerning motion with respect to claimed patterning apertures. In fact, when reviewing the specification in an attempt to find support for Appellants' amendment, the examiner could find no place which told how one positioned the first & aperture patterns with respect to the substrate area being treated in order to perform the 2N-shot laser process, thus lacking any clear or solid example of how the aperture orientations/use is performed, it is not reasonable to say that there is support for eliminating any particular means for achieving the claimed orientations of claimed apertures, such that the explicit negative claim limitation of "without rotating aperture patterns" must be considered to encompass **New Matter**, as it appears to be neither taught nor suggested by the original specification. (The examiner didn't find anything relevant to substrate rotation with respect to apertures either for that matter, although page 19 might be considered to support generic relative movement between mask or apertures & substrate, but nothing particularly specific.)

The following is a quotation of **35 U.S.C. 103(a)** which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 3-21, 23, 25-44 & 65-66 are rejected under 35 U.S.C. **103(a)** as being unpatentable over **Sposili et al.** ((6,908,835 B2) or WO 02/086954 A1, with mention of IM (6,368,945) as incorporated evidence), in view of **Yamazaki et al.** (5,894,137), plus **Fukunaga et al.** (2004/0142543 A1) or **Kawasaki et al.** (6,653,657 B2).

Appellants' claims, as presently written, have additional negative limitations in the independent claim, such that presently it is essentially required that the second aperture pattern be applied to the substrate via any technique, except rotating of the substrate or the apertures, e.g. the mask (which appellants' Summary indicates is the same as rotating the beams or beamlets). The examiner noted that as she could find no particular importance of how one positions or moves substrates or masks in Appellants' process, except for achieving adequate alignment if the mask is moved, but alignment issues are not relevant to the claims as written. In other words, whether apertures are oriented as claimed due to movement of the mask, due to movement of substrate, due to use of different masks, or masks with multiple apertures used at different times, or whatever, there does not appear to be any patentable significance or significant effect in how one achieves one's desired patterning orientations, thus excluding particular means of achieving a sequence of patterning steps, when multiple different means are old and well-known as available therefore, where it is a matter of applying common sense & simple geometry to

determine equivalent means of producing like configurations, then exclusion of obvious alternatives cannot can be considered to provide patentable significance to the claimed process, especially when one does not even know (in either claims or specification) how Appellants intend to achieve the claimed orientations, as we have by their own summary arguments & language excluding their suggested means of configuring the substrate, beams & apertures.

With respect to scope, the examiner previously noted, independent claim 1 excludes changing orientations of first and second patterns by rotation of an aperture pattern, and excludes rotation of the silicon film, which would appear to necessitate that options for effecting patterned irradiation to be in orthogonal directional orientations requiring that the first aperture pattern & the second aperture pattern be physically distinct apertures, either on the same or different masks, where any of the substrate, the mask(s) or the laser may be shifted in order to effect the required first & second steps of the two in shot laser process in the first area, as long as neither the substrate or the aperture patterns (masks) are not rotated in order to achieve the shifting. The examiner noted while the present claim language eliminates one of a number of obvious equivalent techniques for achieving the claimed sequential actions (without specifying how to achieve it), one cannot produce unexpected results or an unobvious process by eliminating one option that is expected to have equivalent results or effects with respect to equally obvious/known ways of performing the same action, i.e. no different effect would have been expected by using a mask pattern that produces a pattern oriented in a first direction, then rotating the mask pattern 90° to produce a pattern (lateral growth) in an orthogonal direction, than if one used 2 masks with the same pattern, but with orthogonal orientations with respect each other (or equivalently two sets of aperture patterns on the same mask that are identical except for orthogonal orientation with respect each other), then changed masks (or laterally shifted to the orthogonal pattern), as the identical irradiation effects would have been expected to be achieved by any of these options. Note that whether one would do all the irradiation with the same mask at one station, or shift the substrate through a series of stations

with masks at desired orientations, would have been expected to be dependent on volume processing considerations, time &/or spatial efficiency produced by single station versus multi-station processing in a manufacturing situation (i.e. continuous versus bulk processing, or the like), which would in & of itself not suggest patentable significance for claimed negative limitations.

While the particularly relevant stage of the example of **Sposili et al**. (835) discussed on col. 24 & illustrated in figure is 13A-D & 14, rotates the substrate 90° in order to perform the equivalent of Appellants' claimed N = 2 or second set of shots, as written, it would've been obvious to one of ordinary skill in the art that the equivalent effect would have been expected to be equally effectively created by rotating the pattern mask, or by using two identical masks oriented at 90° from each other, where either the masks were laterally shifted or the substrate, in order to create the crystallized columns with their grain boundaries, which would have been configured as claimed, as any of these alternatives would reasonably have been expected by one of ordinary skill to produce the same results, if a competent practitioner properly aligns the masking patterns. Such alternatives would have been considered further obvious considering that Sposili et al. (835) specifically teach that the motions for their SLS processing can be performed by controlling the translational motions of the substrate (sample 40) , or **alternately** by using the computer to control the motions of the mask **and/or** the laser (col. 6, lines 19-col. 7, line 17, especially col. 6, line 40-42, col. 7, line 1-10 & 12-15), where they specifically note that the exemplary embodiment controls motioned by translation of the sample, but then explicitly teach the expectation that these other techniques, inclusive of controlling movements of the mask or laser, would have been expected to be equally effective. Sposili et al. (835), also incorporate by reference SN 09/526,585= PN 6,368,945 (**IM**: col. 4, especially lines 8, 11-18, 25-35, 40-45 & 54-56, etc.), which describes an apparatus usable in Sposili et al. (835), and has further teachings concerning the alternative equivalent use of translation of either the sample stage or the mask stage. Note, in col. 22, especially lines 23-37 & 54-63, Sposili et al. (835) at a specific stage of their example, where the mask is rotated 180° in order to

move the grayscale portion (see illustrated masks of figures 11 or 12) over previously irradiated & re-solidified areas, so as to radiate at reduced intensity (≡ possible meanings encompassed by amended claim 25) areas already subject to first & second beamlets (≡ two shots of the laser beam through the patterned apertures), where this additional irradiation is taught to maintain the integrity of the grains grown by the preceding beamlets irradiation. This procedure explicitly shows that the apparatus employed is capable of the alternatively taught means of changing the exposure via movement of the mask assembly versus movement of the substrate, such that one of ordinary skill in the art would have reasonably considered switching masks or the like to make essentially the same configuration as rotating the mask, or another equivalent reasonable alternative. For these reasons, the claimed laser, substrate & aperture configuration, with 2 negative limitations excluding rotation of the silicon film and excluding rotation of apertures, hence excluding rotation of substrate & masks, are not considered to provide patentable significance to the claimed process. See analogous teachings & discussion in Sposili et al. (WO).

The examiner additionally notes that with respect to claim 28 as written, which is equivalent to amended claim 25, except employs a lamp for possibly the same purpose as a laser, that as it is old and well-known in the art of radiation treating substrates, including annealing, that either light or lamp sources may be equivalently employed, depending on the particular lamp & the parameters by which they are adjusted, with it further noted that since Sposili et al. (835) is specifically teaching that their additionally added light radiation is at a reduced intensity, that employing a lamp would have been an obvious alternative, since unless the light from a lamp is sharply focused, it is generally at a lesser intensity than light from a laser, thus using a lamp would have reasonably been expected by one of ordinary skill in the radiation art to have

effected a similar results as using the grayscale portion in the mask, as exemplified on col.22 of Sposili et al. (835).

Also, in column 24, when discussing the final stages of creating the resultant substrate illustrated in figure 14 with the square single grains created between illustrated consecutive pairs of orthogonally related grain boundaries, Sposili et al. when discussing the final stage of the process with respect to figure 13D on lines 44-49 note that lateral grain growth is seeded and promoted from the borders using the grains grown using the process described in reference to figures 5A-G, thus it would've been further obvious to one of ordinary skill in the art, that the step described on col. 22, lines 23-67, which applies additional radiation & also refers to figures 5A-D, would also have been expected to be effectively applied at this point in order to accomplish or aid the taught lateral grain growth, which is a species of directional solidification & may be considered to read on &/or be consistent with the claimed directional solidification process to anneal a second area, where each individual crystal grain between grain boundaries may be considered a second area, or alternately, can be considered related to any of claims 25, 28, 32 or 35, & their dependents, for reasons as discussed above.

In the reference (PN 6,908,835 B2 or WO 02/086954 A1) to **Sposili et al.**, the Appellants were previously particularly directed to the abstract; and figures 13 (esp. 13A) & 14, discussed on col. 5, lines 66-col. 6, line 11 & col. 24, where col. 24, lines 5-18 & 55-58 (in (835), with equivalent teachings in the parent PCT document) are particularly noted. As discussed in the abstract, Sposili et al. ((835) or WO)'s basic process employs two shots while using masks that define a plurality of beamlets for irradiating portions in the two successive shots to thus treat a contiguous area. A particular embodiment discussed with respect to figures 13 & 14, employs the basic process as discussed in the abstract to create SLS crystallization, then rotates the substrate 90° on the translation stage & performs the two shot process

again, hence reading on Appellants' 2N-shot laser irradiation process as now claimed, with above discussed considerations of means of effecting claimed substrate, apparatus & laser configuration. Note the figure 14 in Sposili et al. ((835) or WO), would appear to illustrate creation of single grains, inclusive of alternating crystal orientations, thus apparently inclusive of the direction of lateral growth being rotated 90° from the previous two shot step. As noted in col. 1, lines 5-14+, the techniques taught in Sposili et al. ((835) or WO) are intended to form large grain microstructure from amorphous semiconductor materials, where the grain-boundary-location is controlled, which are desirable to use in fabricating higher-quality devices, inclusive of transistor arrays (col. 1, lines 50-54). **Sposili et al.** ((835) or WO) is directed to this large grain crystallization process for the amorphous silicon/semiconductor films, and does not contain teachings directed towards particular parameters or significance subsequent processing to be employed in the creation of particular semiconductor device structures. However, the references of **Yamazaki et al.** (5,894,137), in view of **Fukunaga et al.** (2004/0142543 A1) or **Kawasaki et al.** (6,653,657 B2), which discuss relevant processing of crystallized amorphous material, particularly with respect to grain structures & device formation, would have provided obvious subsequent processing techniques applicable to the initially recrystallize material for reasons as discussed in previous actions .

With respect to, **Fukunaga et al** (abstract; [0030]; [0087-89]; [0111]; [0128-130]; [0144]; [0156]; & claims), they teach use of lasers, such as KrF excimer lasers, to crystallize amorphous silicon that has had a catalytic element, such as nickel deposit thereon, especially given further analogous teachings of performing further annealing treatments on the crystallized area to improve the crystallinity thereof, along with teachings of lateral growth ([0052-57]; [0059-67]; [0092]; [0114]; & [0131-133]), such that one of ordinary skill would have expected the taught laser crystallization using a catalytic element of Fukunaga et al. to have been effective for the crystallization step of Sposili et al. ((835) or WO), hence in would have been obvious to one of ordinary skill in the art to employ in this claimed

process any energy source known to be effective for metal catalyzed crystallization of amorphous silicon to produce a polycrystalline silicon.

It was noted that the SLS process combines both the claimed laser irradiation and directional solidification annealing processes, where the areas may be the same, or the arbitrary designations of the claim may correspond to areas treated as described in **Sposili et al.** ((835) or WO). With respect to the aperture usage of independent claim 1, note that the 90° rotation will affect the claimed orientation for the second step, especially considering that the second aperture need not necessarily be different than the first aperture.

With respect to the parallel grain boundaries of claim 3 & the claims dependent therefrom, the SLS technique inherently creates grain boundaries at its edges, which as it scans or steps would create a plurality of essentially parallel grain boundaries on opposite sides of the crystallize grain, which for a controlled beam spot & controlled parameters would inherently be equally spaced. The choice of the width would depend on desired enduse combined with parameter control of the laser beam, and as such would have been expected to include widths as claimed, since they are typical dimensions desired for electronic features in semiconductor devices like TFT's, such as are to be formed with the crystallize products of the primary references. That Sposili et al. may use plural patterns in processing of the substrate would indicate that there may be different sets of such crystallized silicon film, with different or the same width, depending on the design requirements for the particular circuitry being created. Alternately, for large patterns that are square or were rectangular as shown in the masking of figure 5, each pulse would give two sets of orthogonal parallel grain boundaries, where patterns with multiple apertures, exemplified by the set of 4 rectangles would provide a plurality of such parallel grain boundaries, and where squares would have first and second widths equal, while rectangles widths are unequal, thus such links are matters of design choice &/or basic geometry.

It remains further noted that the sequential lateral solidification employed by Sposili et al. ((835) or WO), effectively removes or pushes to the end, one side of the grain boundaries and ridges associated therewith, while extending the length of the grain boundaries in the direction of stepping or motion, which would appear to be the types of actions being referred to in claims 12, 13 and like. Note that the transistor arrays discussed by Sposili et al. ((835) or WO) as desirable enduses are old and well-known to require doping, typically via ion implantation, which requires subsequent annealing, thus it would've been obvious to one of ordinary skill in the art to employ typical processing techniques for creating such devices in conjunction with the specific crystallization procedure of Sposili et al. ((835) or WO).

Alternately to Fukunaga et al., **Kawasaki et al.** (657) teach crystallization of amorphous silicon to form polycrystalline with lateral growth, where the crystallization procedure may use heat or laser (single or dual lasers, excimer with single or plural pulses), and may be performed with or without a catalytic element (abstract; col. 1, line 28-col. 2, line 6; col. 3, lines 14-32 & 56-68+; col. 6, line 20-col. 7, lines 68+), hence providing a further showing of the obviousness of using laser crystallization as the energy source for the initial crystallization process of these claims.

As previously noted, the claims has written include first area = second area or significantly overlap therewith, where **Fukunaga et al.** may have a further radiation treatment to enhance the crystallization that may use a strong light such as an infrared **lamp** or may use a second **laser** irradiation procedure, where this annealing step after the initial crystallization step is also said to proceed or is to lead in its crystal growth ([0099], [0114] & [0131-132]), which would read on the alternative option of the laser irradiation process being different from the directional solidification annealing process, but where first area still equals second area.

Yamasaki et al. (137) teach a crystallization process of amorphous silicon, which has been coated with a silicon oxide film, having an aperture that exposes region 405 on to which a catalytic element, such as nickel is introduced, and thereafter heating is performed to cause crystallization, where

lateral growth occurs, however grain boundaries occur between adjacent crystals that are perpendicular to the direction of crystal flow in the base region, i.e. channel result in potential barriers and hinder the flow of current. Therefore, to improve the crystallization in these areas and create "monodomain regions" that are substantially single crystal with no grain boundaries in the crystalline silicon, it is further taught to improve the crystallization via application of **laser** beam, such as excimer lasers (KrF at 248 nm or XeCl at 308 nm), or via rapid thermal annealing using strong light from IR or UV **lamps**. This annealing of the lateral growth region is locally heating high temperatures, such that the metal silicide from the catalytic element is precedently melted, eliminating grain boundaries, in the solidifying to form essentially a single crystal domain in such a way that can be considered to remain lateral or directional. See the abstract; figures; col. 4, line 5-col. 5, line 14 (influence of grain boundaries in TFT); col. 6, lines 39-55; col. 7-8, especially col. 7, lines 10-15, 35-44 & col. a, lines 20-35; col. 9, lines 41-65; col. 11-line 6-55; col. 12, lines 5-42; col. 13, lines 1-60 & 66-col. 14, line 5.

Yamasaki et al. (137) differs from the present claim by initially turning the amorphous crystal into polycrystalline via a thermal process, however as has been seen above with respect to Fukunaga et al. or Kawasaki et al. (sections 15 or 21) it was known to provide equivalent lateral growth crystallization processes using catalytic elements employing either thermal or laser processes, hence as discussed above, it would've been obvious to one of ordinary skill in the art to employ the alternate technique of laser treatment, instead of the purely thermal treatment to induce the crystallization formation.

It is noted that Yamazaki et al. use apertures in their process, and it would've been obvious to one of ordinary skill to use multiple apertures in a process to produce multiple polycrystalline regions forming multiple TFT structures, since designs for circuitry require multiples of such functional structures.

While **Sposili et al.** does not specifically discuss using & selecting a third aperture patterns on a second top area, it relates to a portion of the second area etc., as noted above, they do suggest using their process not just for the initial crystallization, but also for successive annealing processes, which as can be

seen in the above discussed processes of Yamasaki et al. (137), Fukunaga et al. or Kawasaki et al., that the crystallization of amorphous silicon & formation devices such as TFT constructions, may encompass multiple annealing steps, that may employ multiple laser usages, or may employ strong light from lamps in a similar fashion, where the area that was initially crystallized, is again partially or wholly annealed again, possibly both before implanting for TFT formation, and thereafter. Therefore, given Sposili et al.'s suggestion for advantageous enduses, it would have been obvious to one of ordinary skill in the art to employ such sequential annealing processes as taught in Sposili et al. for any of the laser annealing techniques as presented in the above combination of Yamazaki et al. plus Fukunaga et al. or Kawasaki et al., further noting that the previously discussed embodiments exemplified in these references, where they are forming TFT devices, further teach laser annealing after doping, consistent with Sposili et al.'s suggestion of further usage.

With respect to the various claimed combinations of parameters, such as energy density, wavelength, etc., previously noted lamps and lasers employed in the secondary and tertiary references supply various claimed wavelength and pulse duration, etc., parameters for use in their process, as well as all references recognizing the importance of energy or light intensity or energy density impinged on the surface being treated, in order to control the effects of that light in the various crystallization, recrystallization & annealing processes, hence it would've been obvious to one of ordinary skill in the art to employ such teachings in optimizing the success of sequential processes as suggested by this combination, in order to produce desired and reproducible results.

(10) Response to Argument

In appellants' arguments on **page 7-8** of their Brief, with respect to the **112, second** paragraph rejection of **claims 20 5, 28, 32 & 35**, appellants' reasoning appears to require one to read limitations into the claims that are not necessitated by the claim language, and where the claim language is not defined by the specification to have a particular meaning. Furthermore, appellants' arguments are not even stated, so

as to show why one of ordinary skill would necessarily read their claims in light of the specification to be unambiguous, but are crouched in conditional terms "does not necessarily concur..., but if...", so that from these arguments one cannot even tell what they believe their claims to necessarily mean. Appellants cite case law that discusses difficult claim construction, versus ambiguous, however their arguments are not convincing that this is merely a case of difficult claim construction. On page 8, appellants assert that "a practitioner in the art would understand that annealing occurs in response to exposure to two energy densities, especially when read in light of the specification", but do not say where in the specification one should read to draw this conclusion, nor is "annealing occurs in response to" (noun verb structure), the same meaning as the claim language "annealing the first area in response to" (verb noun structure), which ambiguously may have multiple mutually exclusive meanings, as discussed in the rejection.

On **pages 9-10** of the brief, appellants' discuss 112 second rejection of **claims 65-66**, where they merely provide a conclusory statement with respect to be "in response to" language of the claim 65, stating that it is in accordance with the specification, and are not providing any new arguments not already discussed in the above rejection. Appellants also say that they are unsure of the meaning of a quoted fragment of a sentence, however as they have left out the context of the sentence fragment & have not stated exactly what they are unsure about, this statement cannot be clearly responded to, however their discussion of possible other contributing factors with respect to the annealing, would appear to miss the point of the rejection with respect to the ambiguous meaning of the claim language & uncertain relationship with respect to inconsistent nomenclature in preamble & body of the claim. With respect to claim 66 & as indicated in the 112 rejection, the examiner agrees that appellants' stated interpretation of claim 66 on page 10 of the brief is the most strongly implied from the claims' phrasing, however the inconsistencies between the preamble & body of the independent claim, and the lack of clear antecedence, do not actually necessitate this interpretation.

With respect to appellants' arguments for the **112, first** paragraph enablement & written description rejections of **claims 65-66**, in **section 2** of their arguments on **pages 11-12** of the Brief, the discussion of claim 65 appears to miss the point of the scope of the enablement rejection (thus the new matter which is encompassed due to the broader scope), by discussing the results of the process, rather than the starting material, which as presently claimed is a silicon film of unspecified microstructure, which as shown in the rejection is not supported by the specification, in which appellants' arguments have not shown to be supported. Appellants' arguments on the bottom half of page 11 with respect to the possibility of the lateral growing of crystal grains by other than DS annealing appears to assumes that the claim language is unambiguous, however the examiner has not found appellants' arguments with respect to the meaning of "in response to" nomenclature providing a definite meaning in the claims convincing, hence applicant's statement concerning the inaccuracy of the rejection is not convincing, as "in response to the DS annealing" may ambiguously mean an additional techniques done in response to the annealing done by the claimed DS technique, or caused by the DS annealing. Also appellants have not addressed the issue that these claims do not actually require use of the laser, but all processes in the body of the specification do require laser irradiation.

On **page 13** of appellants' arguments, they have discussion of their figure 14, which in the past has been cited as support for enablement of claimed limitations, as indicated in the above 112, first rejection, however it is unclear to the examiner why appellants would expect the MPEP to define the meaning of an arrow symbol, which symbol has a commonly understood meaning, nor why appellants apparently believe that without the discussion in the specification, one of ordinary skill would interpret a set of steps shown in a flow chart as done in series (as indicated by arrows) to be alternate variations or optional. The point of the examiner's discussion, was that this "flowchart" in combination with the specification discussion was too confusing to provide clear support to enable claims as discussed.

With respect **claim 25**, discussed in paragraph bridging **pages 13-14**, appellants' arguments appear to be based on the claim language having no ambiguity, however as discussed above, the claim language of claim 25, i.e. "annealing... in response to..." has two possible meanings, which are mutually exclusive, but only one of which is supported & enabled by the specification, but the specification does not use the same nomenclature as the claims, so you cannot read that nomenclature to exclusively mean the sequence of the specific example cited in the specification. Appellants' arguments on **page 14** with respect to **claims 32 & 35**, would appear to have analogous reasoning with respect to claim language encompassing broader meaning than is enabled by the specification, thus are similarly not convincing.

With respect to the written description (new matter) rejection discussed in **section 4** of appellants' arguments starting on **page 15** of the Brief, appellants cite their discussion in the Summary, which was discussed above with respect to the summary & cite page 6, lines 12-17, but appellants' failed to show any actual support for their negative limitation of excluding both options of rotating the substrate & of rotating the apertures, thus have provided no reasoning to the examiner which is convincing of support for the claim 1's negative limitation, so is not convincing that there is no New Matter encompassed by independent claim 1 & its dependent claims.

Appellants appear to start their actual discussion of the **103** art rejection on the middle of **page 18** of the Brief, where appellants appear to assert that it is necessary for one of the references in the 103 rejection to supply all the criteria of independent claim 1, this is not agreed with. Appellants further discuss that none of the references use a mask with orthogonal apertures, stating that it is thus completely unanticipated by the references, however the examiner notes that appellants' specification & claims have the same deficiency, since nowhere in the body of the specification, original claims or figures, were appellants' able to point out explicit support for such a limitation, which for the claims as written, one must infer means employed by what appellants' have excluded in the negative limitations, hence applicants are arguing for patentable significance, for something that **is not explicitly claimed** & must be

determined by considering what one would obviously use by exclusion using the two negative limitations. Note the claims do not necessitate whether the first aperture pattern & the second aperture pattern are in the same or different structure(s), i.e. mask(s). Furthermore, there is not only way of producing the claimed sequential orientation limitations, i.e. one mask having to orthogonal apertures or two sets of orthogonal apertures thereon is not the only possible remaining means of configuring as claimed, but could also included two separate masks having apertures that orthogonal to each other, used in sequence via shifting of substrate or masks, instead of rotating, which is an alternative configuration which would've been obvious to one of ordinary skill & included by appellants' claim language, and indicating that appellants' arguments for requiring the undisclosed one mask with orthogonal apertures is not necessitated for the claimed procedure. Therefore, appellants' arguments are not providing convincing reasons for patentability over the applied references, and can even be considered to support the examiner's discussed position of obviousness of employing other obvious means of producing equivalent configurations of the substrate, the laser beam(s) & apertures. Appellants' arguments continue to discuss limitations as in the independent claims that are not actually required by the independent claims, a tactic which fails to be convincing. On page 19, appellants assert that the examiner is employing hindsight reasoning, however it would appear if any hindsight is involved, it was first applied by appellants in order to attempt to remove the applied references.

The examiner agrees with appellants' discussion into paragraph bridging pages 20-21, with respect to the references of Yamasaki, Fukunaga & Kawasaki not being applied to address claim 1's limitations with respect to negative limitation means of configuring first & second apertures orthogonally.

It is further noted, that as this issue with respect to achieving claimed aperture orientation in the 2N-shot laser irradiation process is **not relevant** to independent **claim 65** & its dependent **claim 66**, which do not even require the use of lasers as discussed above in the 112 sections (& was not actually addressed in appellants' arguments with respect to the 112's), let alone specific aperture orientations,

hence appellants' have actually not provided any arguments for why the art rejection does not properly apply to claims 65-66, thus effectively conceding their rejection, as all their arguments appear to be directed to limitations not required in claims 65-66.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

(12) For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Marianne L. Padgett/

Primary Examiner, Art Unit 1792

Conferees:

/Timothy H Meeks/

Supervisory Patent Examiner, Art Unit 1792

/Michael Barr/

Supervisory Patent Examiner, Art Unit 1792

/MLP/

1/29/2009

6/3-4/2009